

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

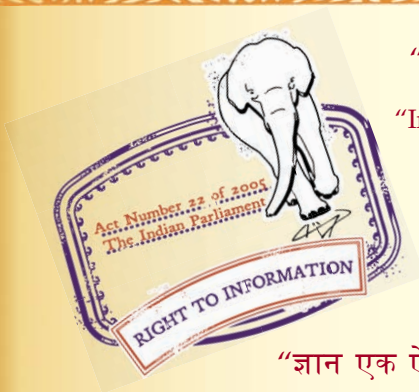
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 6297-2 (1973): Transformers and Inductors (Power, Audio, Pulse and Switching) for Electronic Equipment, Part II: Power Transformers [LITD 5: Semiconductor and Other Electronic Components and Devices]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



Indian Standard
SPECIFICATION FOR
TRANSFORMERS AND INDUCTORS
(POWER, AUDIO, PULSE AND SWITCHING)
FOR ELECTRONIC EQUIPMENT

PART II POWER TRANSFORMERS

UDC 621.314.222.6



© Copyright 1973

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

Indian Standard

SPECIFICATION FOR TRANSFORMERS AND INDUCTORS (POWER, AUDIO, PULSE AND SWITCHING) FOR ELECTRONIC EQUIPMENT

PART II POWER TRANSFORMERS

Transformers and Inductors for Electronic Equipment Sectional
Committee, ETDC 38

Chairman

SHRI R. S. MUNDKUR

Representing

Bharat Electronics Ltd, Bangalore

Members

SHRI C. K. SREENIVAS (*Alternate to*

Shri R. S. Mundkur)

SHRI H. K. L. ARORA

All India Radio & Electronics Association,
Bombay

SHRI R. G. KESWANI (*Alternate*)

(Bombay)

SHRI ARUP CHAUDHURI (*Alternate*)

(Calcutta)

SHRI L. S. V. EASWAR (*Alternate*)

(Madras)

DEPUTY DIRECTOR STANDARDS

Railway Board

(TELE)

ASSISTANT DESIGN ENGINEER

(TELE) (*Alternate*)

SHRI B. P. GHOSH

National Test House, Calcutta

SHRI S. K. HAJELA

Indian Telephone Industries Ltd, Bangalore

SHRI K. N. VISWANATHAN (*Alternate*)

SHRI R. K. JAIN

The Radio Electronic & Television Manufac-
turers' Association (RETMA), Bombay

SHRI T. J. DHABHAR (*Alternate*)

SHRI R. R. JHUSIWALA

Philips India Ltd, Bombay

SHRI M. M. JOSHI (*Alternate*)

SHRI B. MAJUMDAR

The Development Commissioner, Small Scale
Industries, New Delhi

SHRI M. N. MATHUR

Posts & Telegraphs Department, New Delhi

SHRI D. V. PETKAR

Bhabha Atomic Research Centre, Trombay,
Bombay

(Continued on page 2)

© Copyright 1973

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

IS : 6297 (Part II) - 1973

(Continued from page 1)

Members

SHRI P. K. RAO

SHRI ISHWAR DUTT (*Alternate*)

SHRI M. SANKARALINGAM

SHRI G. R. BHATIA (*Alternate*)

SHRI C. G. SUBRAMANYAN

SHRI A. K. DATTA (*Alternate*)

SHRI P. SURYANARAYAN

SHRI T. V. VARADARAJAN

SHRI R. S. YADAV (*Alternate*)

SHRI N. SRINIVASAN,

Deputy Director (Elec tech)

Representing

Directorate General of Inspection (Ministry of Defence)

Directorate General of Supplies & Disposals (DGS & D)

Directorate General of Research & Development (DGRD), Ministry of Defence

National Physical Laboratory (CSIR), New Delhi

Directorate of Technical Development & Production (Air), Ministry of Defence

Director General, ISI (*Ex-officio Member*)

Secretary

SHRI JAGDISH CHANDRA

Assistant Director (Elec tech), ISI

Indian Standard

SPECIFICATION FOR TRANSFORMERS AND INDUCTORS (POWER, AUDIO, PULSE AND SWITCHING) FOR ELECTRONIC EQUIPMENT

PART II POWER TRANSFORMERS

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 17 April 1973, after the draft finalized by the Transformers and Inductors for Electronic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard covers the requirements of transformers intended for use to deliver power in electronic equipment, such as radio receivers, audio amplifiers, small transmitters and similar other devices. This standard supersedes IS: 591-1964* and incorporates the improvements in the methods of measurements and requirements taking into account the experience gained in the implementation of IS: 591-1964* and the developments in the electronic field.

0.3 This standard is to be used in conjunction with IS: 6297 (Part I)-1971† which is a necessary adjunct. Should, however, any deviation occur between IS: 6297 (Part I)-1971† and this standard the provisions of the latter shall prevail. The information to be given along with the enquiry or order is given in Appendix A.

0.4 This standard is one among the series of the Indian Standards for transformers and inductors. A list of standards so far brought out in the series is given on P 12.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS: 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part II) lays down the tests and requirements for power

*Mains transformers for electronic equipment (*revised*).

†Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

‡Rules for rounding off numerical values (*revised*).

IS : 6297 (Part II) - 1973

transformers with one winding (auto-transformers) or more windings of power input not exceeding 2 kVA intended for use in electronic equipments, such as radio receivers, audio amplifiers, small transmitters and similar other devices.

1.2 It does not cover variable voltage type auto-transformers.

1.3 This standard does not cover the dimensional requirements of such transformers.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 6297 (Part I)-1971* shall apply.

3. CATEGORIES AND GRADES

3.1 Categories — The transformers shall fall in any one of the categories specified in 3.1 of IS : 6297 (Part I)-1971*.

3.2 Grades — There shall be two grades of transformers depending on their insulation resistance values (see Insulation resistance test in Table 1).

4. MATERIALS, CONSTRUCTION AND WORKMANSHIP

4.1 The provisions of 4 of IS : 6297 (Part I)-1971* shall apply.

4.2 In the case of lead type terminations, colour code given in Appendix B shall be adopted.

5. FREQUENCY AND VOLTAGES

5.1 Power transformers shall be designed to operate at the standard mains frequency of 50 Hz and at mains input voltage (rms) and tapings as required. The preferred input voltages (rms) are:

200, 220, 230, 240 and 250 volts.

NOTE 1 — In special cases, other frequencies and voltages may be agreed to between the purchaser and the manufacturer.

NOTE 2 — If the transformers are designed for a range of frequencies the tests shall be carried out at the lowest frequency.

6. MARKING

6.1 In addition to those specified in 5.1 of IS : 6297 (Part I)-1971*, the following shall be indelibly marked on each transformer:

- a) Current and voltage ratings, and
- b) Category in accordance with this standard.

NOTE — In case it is not practicable to mark the information on the transformers, this should be furnished separately.

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

6.1.1 The transformers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. TESTS

7.1 General Conditions for Tests — The provisions given in 6.1 of IS : 6297 (Part I)-1971* shall apply.

7.2 Classification of Tests

7.2.1 Type Tests — The provisions of 6.1.6.1 in IS : 6297 (Part I)-1971* shall apply.

7.2.2 Acceptance Tests — The following tests and all the routine tests (see 7.2.3) shall constitute the acceptance tests:

- a) Robustness of terminations,
- b) Soldering,
- c) Efficiency,
- d) Temperature-rise,
- e) Voltage regulation,
- f) Shielding, and
- g) Climatic sequence.

7.2.3 Routine Tests — The following tests shall be carried out on each transformer:

- a) Visual examination,
- b) dc resistance of windings,
- c) Insulation resistance,
- d) Voltage proof (as a flash test),
- e) Induced high voltage,
- f) Primary no-load current,
- g) Open-circuit secondary voltage,
- h) Winding continuity,
- j) Polarity,
- k) Primary tap voltage,
- m) Secondary no-load voltages, and
- n) Hermetic sealing.

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

8. TEST SCHEDULE

8.0 General — The test schedule specifies all tests and the order in which they shall be carried out as well as the requirements to be met with.

8.1 Test Schedule — The test schedule shall be as specified in Table 1.

NOTE 1 — The clause references, conditions of test and requirements specified are applicable for acceptance and routine tests also and the groupings are for the purpose of type tests only (see 7.2).

NOTE 2 — Conditions of tests and the values for the requirements that are to be specified according to IS : 6297 (Part I)-1971* only are given in col 3 and 4 of Table 1. Other conditions and requirements of test are according to IS : 6297 (Part I)-1971*.

TABLE 1 TEST SCHEDULE

(Clauses 3.2 and 8.1)

[See also Appendix A of IS: 6297 (Part I)-1971*]

TEST	CLAU SE REFERENCE OF IS:6297 (Part I)- 1971*	CONDITIONS OF TEST	REQUIREMENT
(1)	(2)	(3)	(4)
<i>All Samples</i>			
Visual Examination	6.3.1	—	—
Dimensions	6.3.2	—	—
Insulation resistance	6.2.1.6	—	The insulation resistance values shall be as stated below: For Grade 1 $\geq 5\ 000\ M\Omega$ For Grade 2 $\geq 1\ 000\ M\Omega$
dc resistance of winding	6.2.1.2	—	The resistance value shall not differ from the stated value more than as specified below: For conductor size $\geq 0.12\ mm \pm 10\%$ For conductor size $< 0.12\ mm \pm 15\%$
No load test	6.2.2.1	—	As specified
Secondary no-load voltages and primary tap voltages	6.2.2.2	—	If any secondary winding has a centre-tap, the rms voltage across each half of that winding shall be between 49.5 and 50.5 percent of the voltage across the entire winding under no-load conditions

(Continued)

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

TABLE 1 TEST SCHEDULE—Contd
 CLAUSE
 REFERENCE
 OF IS : 6297
 (Part I)-1971*

TEST	CLAUSE REFERENCE OF IS : 6297 (Part I)-1971*	CONDITIONS OF TEST	REQUIREMENT
(1)	(2)	(3)	(4)
Efficiency	6.2.2.3	—	—
Voltage regulation	6.2.2.4	—	—
Magnetic shielding (for transformers with shielding only)	6.2.1.4	The voltage corresponding to the largest reading in meter should be noted	—
Electrostatic shielding (for transformers with shielding only)	6.2.1.4	—	The ratio of V_1 to V_2 shall not exceed 5
Voltage proof	6.2.1.7	In the case of fluid-filled transformers, the voltage proof test shall be carried out by mounting the specimens along the three major axes and applying the voltage for 10 s in each of six positions. In subsequent tests the specimen shall have the proof voltage applied in one mounting position only and full test voltage shall be maintained for 1 min. In the case of hermetically sealed transformers, approximately half the samples shall be tested with the specimen in upright position (terminals uppermost) and the remainder in the inverted position	—
Induced high voltage test	6.2.2.5	—	The primary no-load current measured after this test shall not differ by more than 5 percent, when compared to the value obtained in no-load test. There shall be no appreciable change in the insulation resistance
Temperature-rise test	6.2.1.5	—	—

The samples shall then be divided into four groups of three power transformers each, and the power transformers in each group shall undergo the tests specified for each group.

(Continued)

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

TABLE 1 TEST SCHEDULE—Contd

TEST	CLAUSe REFERENCE OF IS : 6297 (Part I)-1971*	CONDITIONS OF TEST	REQUIREMENT
(1)	(2)	(3)	(4)
<i>Group 1</i>			
Hermetic sealing (for sealed transformers only)	6.3.5	Test A, B or C whichever is applicable shall be carried out	—
Soldering	6.3.4	—	—
Robustness of terminations	6.3.3	—	—
Bump	6.3.6	—	The primary no-load current measured after this test shall not differ by more than 5 percent compared to the no-load current value obtained in no-load test
Vibration	6.3.7	—	do
Climatic sequence	6.4.1	—	—
Dry heat	6.4.1.1	—	The insulation resistance measured during this test shall be as stated below: For Grade 1 $\geq 50 \text{ M}\Omega$ For Grade 2 $\geq 10 \text{ M}\Omega$ The measured insulation resistance values at the end of recovery period shall be as below: For Grade 1 $\geq 5\,000 \text{ M}\Omega$ For Grade 2 $\geq 1\,000 \text{ M}\Omega$
Damp heat (accelerated) test (first cycle)	6.4.1.2	One cycle	—
Cold	6.4.1.3	—	As specified in IS : 6297 (Part I)-1971* except that the insulation resistance test shall not be carried out
Low air pressure	6.4.1.4	—	—
Damp heat (accelerated) test (remaining cycles)	6.4.1.5	—	Insulation resistance value measured immediately after removal from the chamber shall be as stated below: For Grade 1 $\geq 1\,000 \text{ M}\Omega$ For Grade 2 $\geq 100 \text{ M}\Omega$ After 24 h recovery, the measured insulation resistance shall be as stated below: For Grade 1 $\geq 2\,500 \text{ M}\Omega$ For Grade 2 $\geq 500 \text{ M}\Omega$ (Continued)

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment : Part I General requirements and tests.

TABLE 1 TEST SCHEDULE—Contd

TEST	CLAUSe REFERENCE OF IS : 6297 (Part I)-1971*	CONDITIONS OF TEST	REQUIREMENT
(1)	(2)	(3)	(4)
Rapid change of temperature	6.4.3	—	The no-load primary current shall not have changed by more than 5 percent compared to the no-load current value obtained in no-load test The insulation resistance shall be as stated below: For Grade 1 $\geq 2\ 500\ M\Omega$ For Grade 2 Test is not applicable
Salt mist	6.5	Duration of exposure shall be 4 days	No-load primary current shall not have changed by more than 5 percent compared to the no-load current value obtained in no-load test
Group 2 Mould growth	6.6	—	As specified
Group 3 Damp heat (long term exposure)	6.4.2	—	Insulation resistance value shall be as stated below: After $1\frac{1}{2}$ hours recovery For Grade 1 $\geq 1\ 000\ M\Omega$ For Grade 2 $\geq 100\ M\Omega$ After 24 hours recovery For Grade 1 $\geq 2\ 500\ M\Omega$ For Grade 2 $\geq 500\ M\Omega$ No-load primary current shall not have changed by more than 5 percent compared to the no-load current value obtained in no-load test
Group 4 Endurance	6.7	The transformer shall be subjected to induced high voltage test and voltage proof test	Insulation resistance shall be as stated below: For Grade 1 $\geq 2\ 500\ M\Omega$ For Grade 2 $\geq 500\ M\Omega$

*Specification for transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests.

APPENDIX A

(Clause 0.3)

INFORMATION TO BE GIVEN ALONG WITH THE ENQUIRY OR ORDER

A-1. The following information should be furnished by the purchaser along with his order or enquiry for mains transformers:

- a) Grade, that is, Grade 1 or Grade 2 according to this standard;
- b) Category according to this standard;
- c) Primary voltage and tapplings required;
- d) Operating frequency, if other than 50 Hz;
- e) Secondary full-load voltage and currents required;
- f) dc resistance of windings;
- g) Efficiency (if lower than 80 percent);
- h) Type of termination;
- j) Resin encapsulated or hermetic sealing, if required, and if hermetically sealed, method of test and method of conditioning as per IS : 589-1961*;
- k) Shielding, if required;
- m) Voltage regulation (if other than 10 percent);
- n) Dimensional limitations; and
- p) Environmental conditions under which the transformer is required to operate.

APPENDIX B

(Clause 4.2)

COLOUR CODE FOR LEADS

B-1. The following colour code shall be employed for identifying different leads:

	Colour
a) <i>Primary Winding</i>	
1) Not tapped	Black (both leads)
2) Tapped:	
Common	Black
Tap	Black and yellow, 50/50 striped design
Finish	Black and red, 50/50 striped design
b) <i>Rectifier Plate Winding</i>	Red
Centre tap	Red and yellow, 50/50 striped design
c) <i>Rectifier Filament Winding</i>	Yellow
Centre tap	Yellow and blue, 50/50 striped design

*Basic climatic and mechanical durability tests for electronic components (*revised*).

- | | |
|--|---|
| d) <i>Filament Winding No. 1</i>
Centre tap | Green
Green and yellow, 50/50 striped design |
| e) <i>Filament Winding No. 2</i>
Centre tap | Brown
Brown and yellow, 50/50 striped design |
| f) <i>Filament Winding No. 3</i>
Centre tap | Slate
Slate and yellow, 50/50 striped design |

NOTE 1 — The termination of the interwinding shield shall be stranded and bare.

NOTE 2 — Wherever it is not practicable to use leads of the recommended colours, they may be suitably marked with paint conforming to the colour code.

INDIAN STANDARDS

ON

TRANSFORMERS AND INDUCTORS FOR ELECTRONIC EQUIPMENT

IS:

1496-1959 Transformers used in vibrator power supplies

1512-1969 Tests and general requirements for IF transformers and RF coils (*first revision*)

2612-1965 Recommendation for type approval and sampling procedures for electronic components

3289-1965 Tests and general requirements for audio frequency transformers and chokes

4002-1967 General requirements and tests for audio frequency transformers and chokes used in transistorized equipment

6297 (Part I)-1971 Transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests